surrogates or the actual tumor position. Corrections are usually limited to translations, and rotational errors, shape change and intra-fractional changes are not corrected for. For targets with a large day-to-day shape variation, or in case of multiple targets with differential motion, generous safety margins have to be used that partly undo the healthy tissue sparing properties of modern radiation techniques such as IMRT and VMAT. Adaptive radiotherapy (ART), e.g. with a Plan-of-the-Day (PotD) strategy has been proposed to overcome this problem. Guidelines for proper selection of patients that need a replanning (e.g. lung, rectum), or implementation of a more labour-intensive PotDworkflow for groups of patients (e.g. cervix, bladder) have been major research topics in recent years.
In this presentation, an overview will be given of current *clinical* implementations of PotD strategies in literature. The library-based PotD procedure as implemented at Erasmus MC for cervical cancer patients will be discussed in more detail. For these patients, a plan library contains 2 or 3 VMAT plans adequate for target shapes and positions corresponding to smaller and larger bladder volumes. Every treatment day, the best fitting plan is selected based on an in-room acquired cone beam CT scan, showing internal anatomy and markers implanted around the primary tumor. The recent PotD implementation in our record & verify system has pathed the way for a more wide-spread application of safe and efficient delivery of library-based PotD strategies, and for more advanced library-based approaches including dynamic plan-library updates.

SP-0620
In-room MR image-guided plan of the day
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The clinical implementation of magnetic resonance image-guided radiation therapy (MR-IGRT) has enabled the daily visualization of internal soft-tissue anatomy with the patient in the treatment position. The information provided by the daily MR, which may not be available in some other online imaging modalities such as cone-beam CT, has allowed us to evaluate the impact of geometric variations in the patient on the planned versus delivered dose on a day to day basis. The availability of daily volumetric MR images, in combination with software tools integrated into the MR-IGRT system, and independent quality assurance tools for online patient-specific QA, has allowed for clinical use of online adaptive MR-IGRT since September 2014.
We report on the first year of clinical experience with online treatment adaptation for over 45 patients treated to various sites including abdomen, pelvis, and thorax, having received more than a total of 150 adapted fractions. Here we describe the clinical implementation and workflow for online adaptive MR-IGRT, provide details on decision criteria for daily plan adaptation, and discuss and compare an online plan adaptation approach to a plan library approach where the plan of the day is selected from a group of plans based on previous patient anatomy. We also discuss limitations of current techniques and future improvements.

OC-0621
A population based library of plans for rectal cancer: design and prospects for margin reduction
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Purpose or Objective: The clinical target volume (CTV) in rectal cancer is subject to considerable shape deformations due to rectal and bladder filling changes, which require large planning target volume (PTV) margins when conventional correction strategies based on bony anatomy are used.
To mitigate errors introduced by shape variations, the library of plans (LoP) approach has been successfully applied for cervical and bladder cancer. For those sites, libraries were created by interpolation of structures of interest defined on CT scans in the full and empty bladder state. However, for rectal patients this approach is not feasible, as a major source of uncertainty is not bladder, but rectal filling.
The purpose of this study was therefore to develop an alternative method for generating structures for a LoP for rectal cancer and to investigate its potential for PTV margin reduction.

Material and Methods: The method proposed is based on 3D population statistics of the shape variation of the rectum CTV, rather than patient specific data derived from several CT scans, allowing the use of only a single planning CT scan for structure generation. The population statistics were derived from shape variation data of thirty three short course radiotherapy (SCRT) patients with daily repeat scans on which the rectum CTV was delineated. Shape variations were defined as standard deviations of (local) perpendicular displacements of the CTV surface, using each patient's planning CT scan as reference.
The LoP CTVs were created by expanding or contracting the planning CTV perpendicular to its surface, proportional to the local statistics of shape variation of the population and a global scaling factor. The scaling factor was tuned such that the largest distance between CTVs was 1 cm. Five CTVs were created; the original CTV, two smaller (max -1, -2 cm) and two larger CTVs (max +1, +2 cm).
To determine the potential of this method, residual errors were calculated by using the most optimal CTV from the library as a reference in computing the shape variation statistics, rather than the original planning CTV. Subsequently, margins were computed for both the conventional and LoP strategy, using a modified version of the van Herk recipe.

Results: An example of the constructed CTV structures is depicted in figure 1a. The original CTV is the middle one; two larger and two smaller CTVs were created using population statistics. Figures 1c and 1d show the required PTV margin for a conventional and a LoP approach, respectively. The difference between the two methods is shown in Figure 1b. The largest reduction was found in the upper anterior part of the CTV: 1.5 cm (≈ 40%).

Conclusion: We have successfully developed a LoP strategy for rectum patients that uses population statistics and scalable expansions, thereby only requiring a single CT scan, as opposed to the current methods for cervix and bladder. Analysis of the residual errors has shown that a potential margin reduction of 40% is possible with this approach.